

1. Learning objectives

2. Success criteria

3. Main concepts

4. Key points

5. Questions

6. Answers

7. Extension

8. Mini plenary

9. Homework

10. Reflection

11. Summary

12. Evaluation

13.2 The life cycle of stars

13.2.1 The main sequence

13.2.2 The red giant phase

13.2.3 The white dwarf phase

13.2.4 The black hole phase

13.2.5 The neutron star phase

13.2.6 The pulsar phase

13.2.7 The supernova phase

13.2.8 The gamma-ray burst phase

13.2.9 The quasar phase

13.2.10 The active galactic nucleus phase

13.2.11 The radio galaxy phase

13.2.12 The Seyfert galaxy phase

13.2.13 The blazar phase

13.2.14 The gamma-ray burst phase

13.2.15 The quasar phase

13.2.16 The active galactic nucleus phase

13.2.17 The radio galaxy phase

13.2.18 The Seyfert galaxy phase

13.2.19 The blazar phase

13.2.20 The gamma-ray burst phase

13.2.21 The quasar phase

13.2.22 The active galactic nucleus phase

13.2.23 The radio galaxy phase

13.2.24 The Seyfert galaxy phase

13.2.25 The blazar phase

13.2.26 The gamma-ray burst phase

13.2.27 The quasar phase

13.2.28 The active galactic nucleus phase

13.2.29 The radio galaxy phase

13.2.30 The Seyfert galaxy phase

13.2.31 The blazar phase

13.2.32 The gamma-ray burst phase

13.2.33 The quasar phase

13.2.34 The active galactic nucleus phase

13.2.35 The radio galaxy phase

13.2.36 The Seyfert galaxy phase

13.2.37 The blazar phase

13.2.38 The gamma-ray burst phase

13.2.39 The quasar phase

13.2.40 The active galactic nucleus phase

13.2.41 The radio galaxy phase

13.2.42 The Seyfert galaxy phase

13.2.43 The blazar phase

13.2.44 The gamma-ray burst phase

13.2.45 The quasar phase

13.2.46 The active galactic nucleus phase

13.2.47 The radio galaxy phase

13.2.48 The Seyfert galaxy phase

13.2.49 The blazar phase

13.2.50 The gamma-ray burst phase

13.2.51 The quasar phase

13.2.52 The active galactic nucleus phase

13.2.53 The radio galaxy phase

13.2.54 The Seyfert galaxy phase

13.2.55 The blazar phase

13.2.56 The gamma-ray burst phase

13.2.57 The quasar phase

13.2.58 The active galactic nucleus phase

13.2.59 The radio galaxy phase

13.2.60 The Seyfert galaxy phase

13.2.61 The blazar phase

13.2.62 The gamma-ray burst phase

13.2.63 The quasar phase

13.2.64 The active galactic nucleus phase

13.2.65 The radio galaxy phase

13.2.66 The Seyfert galaxy phase

13.2.67 The blazar phase

13.2.68 The gamma-ray burst phase

13.2.69 The quasar phase

13.2.70 The active galactic nucleus phase

13.2.71 The radio galaxy phase

13.2.72 The Seyfert galaxy phase

13.2.73 The blazar phase

13.2.74 The gamma-ray burst phase

13.2.75 The quasar phase

13.2.76 The active galactic nucleus phase

13.2.77 The radio galaxy phase

13.2.78 The Seyfert galaxy phase

13.2.79 The blazar phase

13.2.80 The gamma-ray burst phase

13.2.81 The quasar phase

13.2.82 The active galactic nucleus phase

13.2.83 The radio galaxy phase

13.2.84 The Seyfert galaxy phase

13.2.85 The blazar phase

13.2.86 The gamma-ray burst phase

13.2.87 The quasar phase

13.2.88 The active galactic nucleus phase

13.2.89 The radio galaxy phase

13.2.90 The Seyfert galaxy phase

13.2.91 The blazar phase

13.2.92 The gamma-ray burst phase

13.2.93 The quasar phase

13.2.94 The active galactic nucleus phase

13.2.95 The radio galaxy phase

13.2.96 The Seyfert galaxy phase

13.2.97 The blazar phase

13.2.98 The gamma-ray burst phase

13.2.99 The quasar phase

13.3 The end of a star's life

13.3.1 The main sequence

13.3.2 The red giant phase

13.3.3 The white dwarf phase

13.3.4 The black hole phase

13.3.5 The neutron star phase

13.3.6 The pulsar phase

13.3.7 The supernova phase

13.3.8 The gamma-ray burst phase

13.3.9 The quasar phase

13.3.10 The active galactic nucleus phase

13.3.11 The radio galaxy phase

13.3.12 The Seyfert galaxy phase

13.3.13 The blazar phase

13.3.14 The gamma-ray burst phase

13.3.15 The quasar phase

13.3.16 The active galactic nucleus phase

13.3.17 The radio galaxy phase

13.3.18 The Seyfert galaxy phase

13.3.19 The blazar phase

13.3.20 The gamma-ray burst phase

13.3.21 The quasar phase

13.3.22 The active galactic nucleus phase

13.3.23 The radio galaxy phase

13.3.24 The Seyfert galaxy phase

13.3.25 The blazar phase

13.3.26 The gamma-ray burst phase

13.3.27 The quasar phase

13.3.28 The active galactic nucleus phase

13.3.29 The radio galaxy phase

13.3.30 The Seyfert galaxy phase

13.3.31 The blazar phase

13.3.32 The gamma-ray burst phase

13.3.33 The quasar phase

13.3.34 The active galactic nucleus phase

13.3.35 The radio galaxy phase

13.3.36 The Seyfert galaxy phase

13.3.37 The blazar phase

13.3.38 The gamma-ray burst phase

13.3.39 The quasar phase

13.3.40 The active galactic nucleus phase

13.3.41 The radio galaxy phase

13.3.42 The Seyfert galaxy phase

13.3.43 The blazar phase

13.3.44 The gamma-ray burst phase

13.3.45 The quasar phase

13.3.46 The active galactic nucleus phase

13.3.47 The radio galaxy phase

13.3.48 The Seyfert galaxy phase

13.3.49 The blazar phase

13.3.50 The gamma-ray burst phase

13.3.51 The quasar phase

13.3.52 The active galactic nucleus phase

13.3.53 The radio galaxy phase

13.3.54 The Seyfert galaxy phase

13.3.55 The blazar phase

13.3.56 The gamma-ray burst phase

13.3.57 The quasar phase

13.3.58 The active galactic nucleus phase

13.3.59 The radio galaxy phase

13.3.60 The Seyfert galaxy phase

13.3.61 The blazar phase

13.3.62 The gamma-ray burst phase

13.3.63 The quasar phase

13.3.64 The active galactic nucleus phase

13.3.65 The radio galaxy phase

13.3.66 The Seyfert galaxy phase

13.3.67 The blazar phase

13.3.68 The gamma-ray burst phase

13.3.69 The quasar phase

13.3.70 The active galactic nucleus phase

13.3.71 The radio galaxy phase

13.3.72 The Seyfert galaxy phase

13.3.73 The blazar phase

13.3.74 The gamma-ray burst phase

13.3.75 The quasar phase

13.3.76 The active galactic nucleus phase

13.3.77 The radio galaxy phase

13.3.78 The Seyfert galaxy phase

13.3.79 The blazar phase

13.3.80 The gamma-ray burst phase

13.3.81 The quasar phase

13.3.82 The active galactic nucleus phase

13.3.83 The radio galaxy phase

13.3.84 The Seyfert galaxy phase

13.3.85 The blazar phase

13.3.86 The gamma-ray burst phase

13.3.87 The quasar phase

13.3.88 The active galactic nucleus phase

13.3.89 The radio galaxy phase

13.3.90 The Seyfert galaxy phase

13.3.91 The blazar phase

13.3.92 The gamma-ray burst phase

13.3.93 The quasar phase

13.3.94 The active galactic nucleus phase

13.3.95 The radio galaxy phase

13.3.96 The Seyfert galaxy phase

13.3.97 The blazar phase

13.3.98 The gamma-ray burst phase

13.3.99 The quasar phase

Sep 29-15:54

1. Learning objectives

2. Success criteria

3. Main concepts

4. Key points

5. Questions

6. Answers

7. Extension

8. Mini plenary

9. Homework

10. Reflection

11. Summary

12. Evaluation

13.2 The life cycle of stars

13.2.1 The main sequence

13.2.2 The red giant phase

13.2.3 The white dwarf phase

13.2.4 The black hole phase

13.2.5 The neutron star phase

13.2.6 The pulsar phase

13.2.7 The supernova phase

13.2.8 The gamma-ray burst phase

13.2.9 The quasar phase

13.2.10 The active galactic nucleus phase

13.2.11 The radio galaxy phase

13.2.12 The Seyfert galaxy phase

13.2.13 The blazar phase

13.2.14 The gamma-ray burst phase

13.2.15 The quasar phase

13.2.16 The active galactic nucleus phase

13.2.17 The radio galaxy phase

13.2.18 The Seyfert galaxy phase

13.2.19 The blazar phase

13.2.20 The gamma-ray burst phase

13.2.21 The quasar phase

13.2.22 The active galactic nucleus phase

13.2.23 The radio galaxy phase

13.2.24 The Seyfert galaxy phase

13.2.25 The blazar phase

13.2.26 The gamma-ray burst phase

13.2.27 The quasar phase

13.2.28 The active galactic nucleus phase

13.2.29 The radio galaxy phase

13.2.30 The Seyfert galaxy phase

13.2.31 The blazar phase

13.2.32 The gamma-ray burst phase

13.2.33 The quasar phase

13.2.34 The active galactic nucleus phase

13.2.35 The radio galaxy phase

13.2.36 The Seyfert galaxy phase

13.2.37 The blazar phase

13.2.38 The gamma-ray burst phase

13.2.39 The quasar phase

13.2.40 The active galactic nucleus phase

13.2.41 The radio galaxy phase

13.2.42 The Seyfert galaxy phase

13.2.43 The blazar phase

13.2.44 The gamma-ray burst phase

13.2.45 The quasar phase

13.2.46 The active galactic nucleus phase

13.2.47 The radio galaxy phase

13.2.48 The Seyfert galaxy phase

13.2.49 The blazar phase

13.2.50 The gamma-ray burst phase

13.2.51 The quasar phase

13.2.52 The active galactic nucleus phase

13.2.53 The radio galaxy phase

13.2.54 The Seyfert galaxy phase

13.2.55 The blazar phase

13.2.56 The gamma-ray burst phase

13.2.57 The quasar phase

13.2.58 The active galactic nucleus phase

13.2.59 The radio galaxy phase

13.2.60 The Seyfert galaxy phase

13.2.61 The blazar phase

13.2.62 The gamma-ray burst phase

13.2.63 The quasar phase

13.2.64 The active galactic nucleus phase

13.2.65 The radio galaxy phase

13.2.66 The Seyfert galaxy phase

13.2.67 The blazar phase

13.2.68 The gamma-ray burst phase

13.2.69 The quasar phase

13.2.70 The active galactic nucleus phase

13.2.71 The radio galaxy phase

13.2.72 The Seyfert galaxy phase

13.2.73 The blazar phase

13.2.74 The gamma-ray burst phase

13.2.75 The quasar phase

13.2.76 The active galactic nucleus phase

13.2.77 The radio galaxy phase

13.2.78 The Seyfert galaxy phase

13.2.79 The blazar phase

13.2.80 The gamma-ray burst phase

13.2.81 The quasar phase

13.2.82 The active galactic nucleus phase

13.2.83 The radio galaxy phase

13.2.84 The Seyfert galaxy phase

13.2.85 The blazar phase

13.2.86 The gamma-ray burst phase

13.2.87 The quasar phase

13.2.88 The active galactic nucleus phase

13.2.89 The radio galaxy phase

13.2.90 The Seyfert galaxy phase

13.2.91 The blazar phase

13.2.92 The gamma-ray burst phase

13.2.93 The quasar phase

13.2.94 The active galactic nucleus phase

13.2.95 The radio galaxy phase

13.2.96 The Seyfert galaxy phase

13.2.97 The blazar phase

13.2.98 The gamma-ray burst phase

13.2.99 The quasar phase

Sep 29-15:54

(6) M - Recall the evolution of a low mass and high mass star

(7) S - Describe, compare and contrast the characteristics of a neutron star and black hole

(8) C - Describe and explain trends using an HR diagram

Mini plenary

As a class - piece together the evolution of a star. Each student adds a new piece of information in turn.

Extension: Contrast with a high mass star by stating the main differences.

Six from:

Matter/gases/dust attracted by gravitational forces

GPE converted to gain in KE (rise in temperature)

Temperature high enough for hydrogen to begin fusion process

Hydrogen/fuel runs out so core of Sun begins to collapse

Hydrogen fusion continues in the outer layers of Sun

Sun expands to form red giant

Outer layers drift away/form planetary nebula

Core forms a white dwarf/slowly cools and becomes dimmer

ALLOW alternative wording

Maximum five out of six if the sequence of events is incorrect

Sep 29-15:54

(6) M - Recall the evolution of a low mass and high mass star

(7) S - Describe, compare and contrast the characteristics of a neutron star and black hole

(8) C - Describe and explain trends using an HR diagram

Mini plenary - Extension answers

Extension: Contrast with a high mass star by stating the main differences.

2. Antares is a red supergiant star in the constellation Scorpius.

b. The future evolution of Antares will be very different from that of our own Sun. Describe how you would expect Antares to evolve.

Four from:

Temperature rises as super giant's core collapses

Helium fusion/burning starts in core

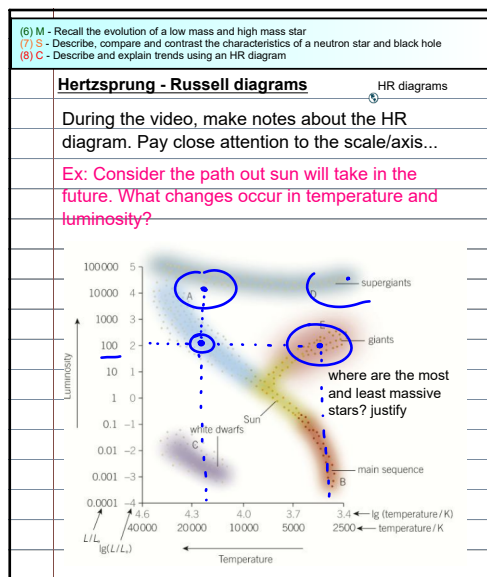
Supernova explosion occurs

If mass of core is greater than Chandrasekhar limit a neutron star is formed

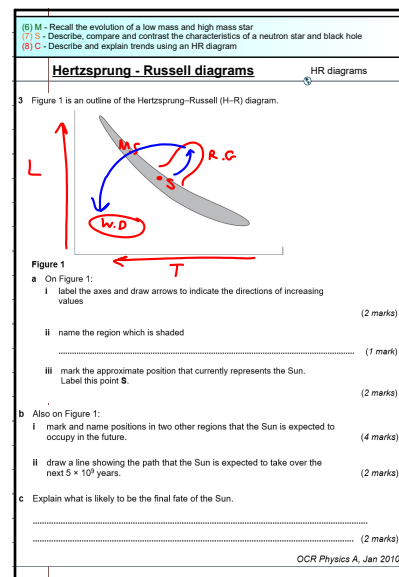
If mass of core is greater than ~3 time mass of Sun a black hole is formed

Other relevant points, for example, formation of heavier elements, fusion of elements up to iron, reference to Schwarzschild radius

Sep 29-15:54



Sep 29-15:54



Sep 29-15:54

Sep 29-15:54

Sep 29-15:54